TAXONOMIC NOTES ON THE ORDER EMBIOPTERA. XVIII.

THE GENUS OLIGOTOMA WESTWOOD.

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(Eighty-three Text-figures.)

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Genus Oligotoma Westwood 1837.

Trans. Linn. Soc. London, 17, p. 373 (as subgenus of *Embia* Latreille 1829). Raised to generic rank, Burmeister, 1839, *Handbuch der Entomologie*, Bd. II, p. 770. Genotype, *Oligotoma saundersii* Westwood 1837, l.c.

Medium to small Embioptera, the males with the following characters: Winged or wingless; if winged, R_1 usually confluent subterminally with R_{2+3}; R_{4+5}, M, and Cu_{1a} simple; R_{4+5} subobsolescent terminally, M and Cu_{1a} subobsolescent throughout. First segment of hind tarsi elongate, with a ventral bladder terminally, the remainder of the ventral surface clothed with setae. Tenth abdominal tergite cleft longitudinally, division usually subobsolescent anteriorly, sometimes continued to ninth tergite as a groove; hemitergites always in contact basally, not separated by membrane. Right hemitergite with outer margin produced backward and inward to a long process, straight or slightly sinuous, at least four times as long as thick, internal margin basally overlying an obtuse flap, sclerotized only medially. Left hemitergite with a process, simple or complex. First segment of left cercus subcylindrical to strongly clavate, never echinulate; second segment distinct, subcylindrical, at least three times as long as thick. Left cercus-basipodite often complex.

Differentiated from *Navásiella* Davis, *Diradius* Friederichs, and *Oligembia* Davis, by the simplicity of R_{4+5}; from *Teratembia* Krauss by the simplicity of R_{2+3}; from *Anisembia* Krauss and *Mesembia* Ross by the lack of nodules on the first segment of the left cercus; from *Saussurembia* Davis by the presence of an inner process on the right hemitergite; and from *Burmitembia* Cockerell, *Notoligotoma* Davis and *Metoligotoma* Davis, by the altogether different form of the terminalia, especially the left cercus. The above represents a list of only one salient point of difference from each of a number of genera; many other criteria might be selected in each case. Nevertheless, members of several of the above have been wrongly referred to *Oligotoma* at some time (*Oligembia hubbardi* (Hagen), *Navásiella sulcata* (Navás), *Notoligotoma hardyi* (Fried.), *Anisembia texana* (Mel.), *Mesembia hospes* (Myers), *Saussurembia ruficollis* (Sauss.)). In the case of *Mesembia*, *Saussurembia*, *Anisembia* and *Notoligotoma*, this incorrect generic classification has been due to convergence in the venation; in the case of *Navásiella*, no charitable explanation for the confusion with *Oligotoma* can be found.

The possibility of an obscure relationship between *Oligotoma* and *Oligembia* (and possibly other related genera such as *Diradius* and *Teratembia*) has been mentioned earlier (Davis, 1939*b*). In no other case does there seem to be any possibility of true relationship between *Oligotoma* and the above genera, the resemblance being merely superficial (small size, etc.) or convergent (loss of R_5).

The closest relative of *Oligotoma* appears to be the wingless Mediterranean genus *Haploembia* Verhoeff, in which there is agreement, general though not exact, in the form of the terminalia. *Haploembia*, however, has two relatively large hind metatarsal bladders.

Enderlein (1912, p. 72) gives additional generic characters in the process of the ♂ left cercus-basipodite, and the reduced first abdominal sternite of the ♀. In his 'Nachtrag', Enderlein (1912, pp. 108-109) notes that other genera may have a process to the left cercus-basipodite (labelled by him, in the main part of his work, 'ast_6' or Anhang des 9. Sternites). It has been noted (Davis, 1939*c*) that this may include the left half of the larval tenth sternite in some cases; in some species of *Oligotoma* (including the genotype, *O. saundersii*) the true cercus-basipodite appears to have a process, and in addition there is present a latero-ventral process on the left of the hypandrium, which may represent the left half of the larval tenth sternite. In other species, however (e.g. *Oligotoma scottiana* End., *O. gurneyi* Frogg.) the structure appears to be composite (basipodite + tenth sternite), as in most other genera. This character thus fails as a generic criterion.

In all members of the Order studied in both sexes, the first abdominal sternite agrees in the two sexes of one species. In *Oligotoma*, this sternite is rather small (cf. Fig. 11); it is also reduced in all other genera studied by me, often little less so, if at all, than in *Oligotoma*. As might be expected, *Clothoda* has least reduction (Davis 1939*c*). The character seems of little value generically, as no clear line seems to be present, the degree of reduction varying continuously from genus to genus.

The genus *Aposthonia* Krauss 1911 (*Zoologica*, Hft. 60, Bd. 23, p. 48; genotype *A. vosseleri* Krauss 1911, l.c.) is rejected as a synonym of *Oligotoma*. Reasons for this course have been stated previously (Davis, 1936, p. 233). The wings, tarsi and terminalia agree exactly with the present generic description.

Oligotoma saundersii Westwood 1837, *Trans. Linn. Soc. London*, 17, p. 373, and *Oligotoma humbertiana* (de Saussure 1896) = *Embia humbertiana* de Saussure, *Mitt. Schweiz. entom. Gesellschaft*, Bd. 9, Hft. 8, p. 353.—These two species have been dealt with already in this series (Davis, 1939*a*). The synonymy and distribution have been fully discussed, and no further purpose would be served by repeating them here.

Oligotoma nigra Hagen 1885. Fig. 1.

Canad. Entomologist, 17, p. 174.—*Embia nigra* Hagen, 1866, *Verh. zool. bot. Ges. Wien*, 16, p. 221—nom. nud.

Hagen's four cotype males are preserved in the Museum of Comparative Zoology. One is from Cairo, Egypt, coll. Schaum, the other three from Upper Egypt. I have selected the male from Cairo as lectotype, in view of the exactitude of the locality (Rhoda Island, Cairo; cf. Hagen, 1885, p. 175). The other specimens are structurally indistinguishable from the lectotype, which is described below. They are of the same size and colour.

♂ (dry). Length 7·5 mm.; forewing 7·5 × 1·4 mm.; hindwing 6 × 1·4 mm. Colour chestnut-brown, eyes black, wing-veins dark brown, bordered by rather pale-brown bands. Eyes rather large; sides of head behind eyes rounded. Mandibles

as in *O. saundersii*. Wings and tarsi as throughout the genus. Terminalia (Fig. 1) with division of tenth abdominal tergite apparently reaching ninth tergite; outer process of right hemitergite ($10RP_1$) long, smoothly tapered, subobtuse, terminally curved slightly to the right. Inner process ($10RP_2$) normal. Process of left hemitergite (10LP) elongate, simple, tapered, curved slightly to the left, with an oblique line crossing it subterminally. Right cercus with two subcylindrical segments (RC_1, RC_2), basipodite small, subannular. Left cercus with segments (LC_1, LC_2) subequal to right. Hypandrium tapered back to an elongate process (HP), distally truncate, apparently with a tubular membrane (? aedeagus) dorsally; left-hand margin of HP with a subterminal spine (HP_1), sigmoid, terminally acute. Left cercus-basipodite (LCB) separating base of left cercus from hypandrium, flat, produced inward and backward, terminally obtuse, weakly bilobed.

♀. Hagen's two female cotypes, also from Cairo, agree in colour with the males; they seem to be indistinguishable from the females of other species. The lengths are 8 mm. and 9 mm.

Note.—The figure of Enderlein (1912, fig. 59) is obviously from a much-distorted specimen, as noted by Friederichs (1934, p. 415). The latter author (l.c., p. 414 et seq.) gives some interesting bionomical notes on specimens collected at the type locality; he also records the species (♂) from Tel Aviv, Palestine (coll. Bodenheimer).

Synonymy and Distribution.—The species is widespread in Egypt, Palestine and Mesopotamia, often associated with the date-palm. In the British Museum of Natural History are males from the following localities: Cairo, Egypt, coll. W. J. Hall (in alcohol; somewhat paler, therefore, than the dried types). Palestine: Jericho, 28/5/18, E. E. Austin; nr. Jaffa, 2/9/18, E. E. Austin. Arabia: Mecca, 29/1/34, H. St. J. B. Philby. Mesopotamia: Baghdad; Basra; Amara (all coll. P. A. Buxton); Baghdad (coll. H. Scott). The series from Amara has been correctly determined by Silvestri (1923). The specimens from Baghdad collected by Scott represent cotypes of *Oligotoma mesopotamica* Esben-Petersen (1929*a*, *Entom. Mon. Mag.* (3), 15, no. 169, p. 7; nom. nud. by Hugh Scott, foreword on same page). This species is therefore a synonym; the Baghdad series agree with the types in colour, size and detailed structure. The synonymy has been noted by Morton (1929), but denied by Esben-Petersen (1929*b*), who had not seen Hagen's types.

Oligotoma nigra has been introduced into the United States with the date-palm, and is now fairly common in California, Arizona, and adjacent States. Specimens in the Museum of Comparative Zoology include a long series from Tucson, Arizona, collected at light by Dr. F. M. Carpenter, who informs me that the only nest found at the time was in a date-palm. Melander (1903, p. 101) records the presence of Embioptera (incorrectly referred to as *Embia mauritanica* Lucas) on date-palms imported into the United States.

This introduction explains the identity of the species *Embia californica* Banks 1906 (*Trans. Amer. Ent. Soc.*, 32, p. 1; *Oligotoma californica* Banks, 1924, *Bull. Mus. Comp. Zool. Harvard*, 65, no. 16, p. 421[1]). The type (penultimate instar ♂; Los Angeles, California) is in the Museum of Comparative Zoology. It is an *Oligotoma*, but the specific characters (of the mature male) are not developed.

[1] The female figured by Banks (1924, Pl. i, fig. 11) is probably an undescribed species of *Aniscmbia*; the specimen figured is probably one of a series in the Museum of Comparative Zoology from Niles, nr. San Francisco, California.

The synonymy *E. californica* Banks = *O. nigra* Hagen is further strengthened by a ♂ (Museum of Comparative Zoology) from Mecca, California (date-palm), identified by Banks as '*Embia* ? *californica*'; it is a characteristic specimen of *O. nigra*.

The male described by Hagen (1885, p. 154) as *Oligotoma michaeli* M'Lachlan (from Amballa, Kumaon Himalayas) is in the Museum of Comparative Zoology. The exact identity of *O. michaeli* is doubtful (infra), but Hagen's identification is certainly incorrect. His specimen is structurally indistinguishable from *O. nigra*; it is darker than the Egyptian (type) and Mesopotamian specimens, and slightly larger (length 8·5 mm.), possibly because it is preserved in alcohol; drying sometimes appears to darken a specimen, as the pale intersegmental membranes lose prominence, but it usually renders the sclerite somewhat paler. The record extends the range of *O. nigra* to India with certainty.

Oligotoma greeniana Enderlein 1912. Figs. 2-11.

Coll. zool. de Selys-Longchamps, fasc. 3, p. 82, fig. 55.

Enderlein's figure is very confused, showing no process on the left hemitergite, the end of the true process of the left hemitergite being labelled ninth sternite, with no anterior attachment indicated. The species is here re-described from three males and one female, collected by the writer at Colombo, Ceylon. Enderlein's specimens were from Peradeniya, Ceylon, coll. Green. Friederichs (1923, p. 6) has noted the occurrence of this species near Colombo (Mt. Lavinia, etc.), but has not described the male. Two males in the Colombo Museum (Peradeniya, coll. Green, 1910), probably of the series from which Enderlein received the type specimens, agree with the present description of the better-preserved Colombo specimens.

♂. Length 6–7 mm.; head 0·9–1·0 × 0·8 mm.; forewing 4·5–4·8 × 1·2–1·4 mm.; hindwing 3·8–4·0 × 1·2–1·4 mm. (Enderlein's data for the types are: Length 6·5–7 mm.; length of forewing 6 mm., of hindwing 4·5–4·8 mm.). General colour dark chocolate-brown, eyes black, wings with dark-brown veins bordered by mid-brown bands. Head (Fig. 2) broad, with eyes prominent, sides behind eyes rounded. Mandibles as in *O. saundersii*. Wings (Fig. 3) and hind tarsi (Fig. 4) as throughout the genus. Terminalia (Figs. 5–10) complex; outer process of right hemitergite ($10RP_1$) with a terminal dorsal hook (Figs. 6–7), and a flat subacute ventral flange on the left; membraneous inner part of $10RP_1$, basally overlying inner process ($10RP_2$), rather broad. $10RP_2$ normal. Process of left hemitergite (10LP) broad, irregularly tapered, left half of basal portion almost membraneous, not pigmented; termination of 10LP heavily-sclerotized, complex, with a terminal ventral flange on the left, obtusely bifid, and a small subterminal acute spine on the right and above (Fig. 8). Right cercus with two subcylindrical segments (RC_1, RC_2), with a subannular basipodite (RCB). Left cercus with first segment (LC_1) slightly clavate, second (LC_2) subcylindrical. Hypandrium (H) produced backward to an obtuse elongate process (HP), laterally more or less membraneous, medially sclerotized and pigmented; HP with a subterminal lobe on the left, dorsally membraneous, tubular (apparently the aedeagus). Base of left cercus separated from H by a plate-like basipodite (LCB), produced backward as a flat subtriangular lobe. An acute process (HP_1), fused to the left-hand margin of H to the right of LCB, probably represents the left half of the larval tenth sternite; in some other species, the structure classed and labelled as the left cercus-basipodite is probably a composite structure, including as the distal part the process here labelled HP_1.

♀. Length 8 mm., head 0·9 × 0·8 mm. General colour, tarsi, and first abdominal sternite (Fig. 11) as in the male. Apparently indistinguishable from the females of other species of *Oligotoma*.

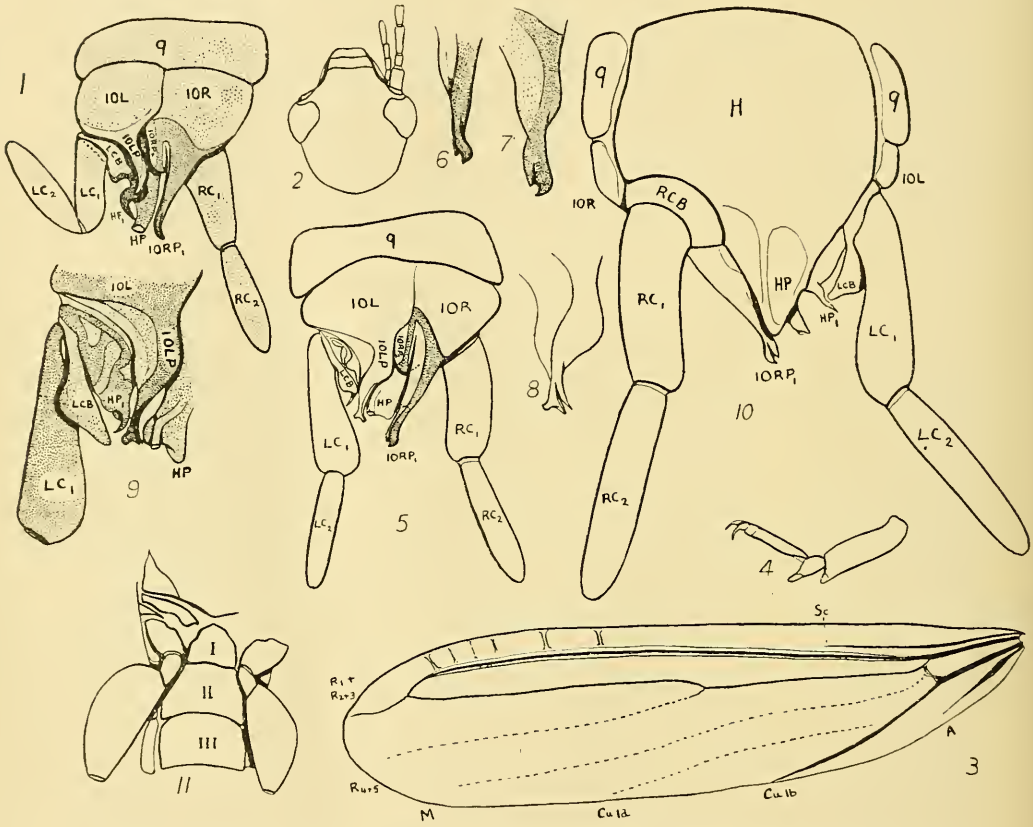


Fig. 1.—*Oligotoma nigra* Hagen, cotype ♂ (lectotype), terminalia from above, × 30.

Figs. 2-10.—*Oligotoma greeniana* Enderlein, ♂ from Colombo. 2. Head from above, × 20. 3. Left forewing, × 20. 4. Hind tarsus viewed laterally, × 40. 5. Terminalia from above, × 40. 6. Outer process of right hemitergite from above, × 60. 7. The same, from above and to the left, × 60. 8. Process of left hemitergite from above, × 60. 9. Base of left cercus and associated structures, viewed from above, × 60. 10. Terminalia from below, × 60.

Fig. 11.—*Oligotoma greeniana* Enderlein, ♀ from Colombo. First abdominal sternite and adjacent structures, × 20 (I, II, III, abdominal sternites).

Setae omitted except in Figs. 13, 18 (wing-fringe), 20, 22, 38 (setae on antennal segments) and 24, 40 (tarsal segments).

All original figures based on camera lucida outlines except 32 and 46-48, which were prepared with constant reference to an ocular micrometer.

Conventional lettering for venation.

9, ninth abdominal tergite; 10L, 10R, left and right hemitergites of tenth abdominal segment; 10LP, process of 10L; $10RP_1$, $10RP_2$, posterior and inner processes of 10R; LC_1, LC_2, RC_1, RC_2, first and second segments of left and right cerci; LCB, RCB, left and right cercus-basipodites; VIII, eighth abdominal sternite; H, hypandrium; HP, main process of hypandrium; HP_1, lateral (left) subterminal process of hypandrium (probably included under LCB in species where it is not labelled as distinct; v. text).

Distribution.—Peradeniya, Ceylon, coll. Green (Enderlein's types, Mus. Stettin; ♂, Colombo Museum); Mt. Lavinia, Ceylon (Friederichs, 1923); Colombo, Ceylon (♂, ♀, in the Macleay Museum, Sydney University; ♂ in the British Museum). Surigao, Mindanao, Philippine Isds. (a male in the Museum of Comparative Zoology, Harvard University, structurally indistinguishable from Ceylon specimens; length 5·5 mm.; head 1·1 × 0·8 mm.; forewing 4·8 × 1·1 mm.; hindwing 4·2 × 1·1 mm.).

Specimens in the Colombo Museum indicate that this species is common and widespread in Ceylon.

OLIGOTOMA WESTWOODI Hagen 1885. Figs. 12–19.

Canad. Entomologist, 17, p. 171 (nom. nud., Hagen, 1866, *Verh. zool. bot. Ges. Wien*, 16, p. 222).

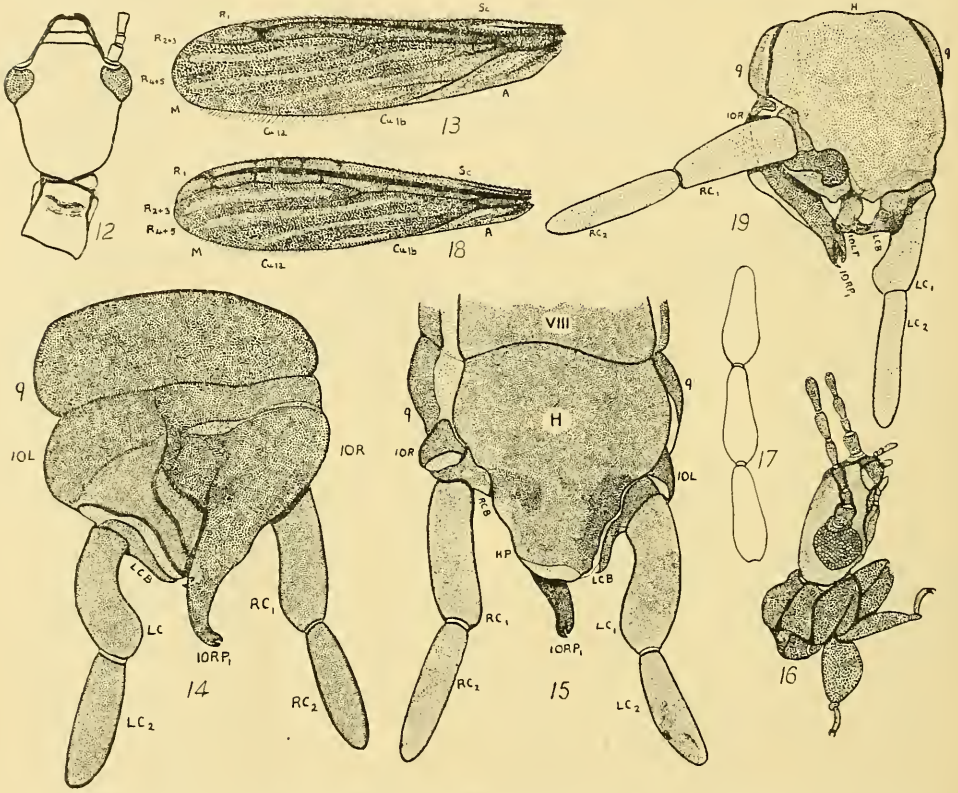
Hagen's two cotypes (♂), in copal (?Zanzibar), are in the Museum of Comparative Zoology. I am much indebted to Dr. F. M. Carpenter, of Harvard University, for assistance in grinding and clearing the cracked copal blocks in which they were embedded.

The two cotypes are apparently conspecific, with minor differences in the wings and antennae, as noted by Hagen (1885, p. 173). In one copal block, there is a Braconid embedded in addition to the *Oligotoma*; in the other, the *Oligotoma* is alone present; the specimens are herein referred to as cotype A (with Braconid) and cotype B respectively.

♂. A: Head 0·7 × 0·55 mm.; length of thorax 1·5 mm., of abdomen 2·1 mm.; total length 4·3 mm. Forewing 3·2 × 0·8 mm.; hindwing 2·5 × 0·8 mm. B: Length of head 0·7 mm., of thorax 1·5 mm., of abdomen 1·3 mm.; total length 3·5 mm.; forewing 3·0 × 0·75 mm.; hindwing 2·5 × 0·75 mm. General colour (by comparison with balsam mounts of recent species) golden-brown, head very dark brown; wings with R_1 and stem of cubitus dark brown, other veins paler, wing-bands pale brown. Head (Figs. 12, 16) with large prominent eyes, sides behind eyes rounded, converging posteriorly. Antennae apparently complete in both cotypes, terminal segment rounded, equal number of segments on left and right; exclusive of the small basal sclerite, there are 15 segments in cotype A, 14 in B; each antenna about 1·5 mm. long. Distalia (Fig. 17) slightly dilated distally. Prothorax with a transverse furrow in anterior third (Figs. 12, 16). Legs as in all recent species of *Oligotoma*. Wings slightly different in the two cotypes; in cotype A, R_1 is connected subterminally by a thick cross-vein to R_{2+3}, and also gives off a twig towards the margin; no other cross-veins present (Fig. 13; all four wings of same structure). In cotype B, more cross-veins are present, somewhat variable in the four wings, some five from R_1 to costa, four from R_1 to sector. Terminalia (Figs. 14, 15, 19) complex; in cotype B, the wings almost wholly obscure the dorsal view, but the ventral view, allowing for a somewhat different arrangement of the various structures due to position at death, agrees well with cotype A. Posterior process of right hemitergite ($10RP_1$) elongate, slightly tapered, distally curved outward slightly, bidentate; outer tooth acute, incurved, inner subacute, straight. Inner process ($10RP_2$) normal in shape; the medial chitinization seen in other members of the genus is not apparent. Process of left hemitergite (10LP) tapered, terminally bent outward and downward as an acute hook. Right cercus with two subcylindrical segments (RC_1, RC_2), the first very slightly clavate, and bent inwards in cotype A. Basipodite (RCB) apparently produced posteriorly, irregularly sclerotized. Left cercus with two subcylindrical segments (LC_1, LC_2), the first slightly incurved and dilated subterminally on the inner side. Hypandrium

(H) tapered posteriorly, obtusely truncate. Left cercus-basipodite (LCB), between H and base of LC_1, acutely tapered, terminally curved outward.

The age of these specimens may be taken as Pleistocene, of the order of half-a-million years old. According to Hagen's data (l.c.), they probably originated from Zanzibar.



Figs. 12-15.—*Oligotoma westwoodi* Hagen, cotype ♂ (A). 12. Head and prothorax from above, × 30. 13. Left forewing, × 16. 14. Terminalia from above, × 64. 15. Terminalia from below, × 64.

Figs. 16-19.—*Oligotoma westwoodi* Hagen, cotype ♂ (B). 16. Head, prothorax and front legs, viewed from right, in front, and slightly above, × 30. 17. Antenna: Three of distalia, × 64. 18. Left forewing, × 16. 19. Terminalia from below, × 64 (more from the right and behind than the view of cotype A in fig. 15).

Oligotoma michaeli M'Lachlan 1877. Figs. 20–21.

J. Linn. Soc. London, Zool., xiii, no. 70, p. 383, Pl. xxi.

The type ♂ (M'Lachlan Collection, British Museum) lacks the terminalia. There seems, therefore, little hope of recognizing the species. Its original locality is not exactly known; it was collected in a London orchid-house in the roots of *Saccolobium retusum*, presumably from India. M'Lachlan's remarks concerning the terminalia would fit many known species of *Oligotoma*, and his figure (l.c., Pl. xxi, 3) is obviously inaccurate; it shows only nine abdominal tergites, the last symmetrical, semicircular and entire.

The following details of the type, which has rather unusual antennae and head-structure, may serve to identify with it more complete specimens collected in the future:

♂. (Length 10·5 mm., after M'Lachlan); head 2·1 × 1·6 mm.; forewing 9 × 2·1 mm.; hindwing 7·5 × 2·1 mm. General colour dark chocolate-brown (M'Lachlan gives 'deep black, somewhat shining'; this probably accounts for his description of *Embia persica*, in the same work, as of this colour, whereas more recently collected series are brown; there seems to be a tendency in some of the early works to describe the colour of dark-brown specimens as black). Wing-veins dark brown, bordered by smoky-brown bands. Head (Fig. 20) elongate; eyes prominent, sides of head behind eyes converging posteriorly. A depression occupies the region posterior to the clypeus; it is subrectangular, opening forward. Left antenna broken; right with 21 segments, also incomplete (M'Lachlan gives 24 segments). The 20th and 21st segments, and the distal half of the 19th, are cream, the rest dark brown. The distalia, except the last few, have very peculiar hairs, length greater than the breadth of the segment, hairs undulating or waved. Wings (Fig. 21) normal for the genus, with some 4 cross-veins each between costa and R_1 and R_1 and sector.

In the M'Lachlan Collection are two immature specimens, almost entirely decayed. They were collected at the same time as the type, but do not help to place the species. It will thus be seen that the identity of *O. michaeli* is unknown, and, probably, will remain so.

Three authors have re-described the species without reference to the type; each handled a different species, and in no case, probably, the same species as M'Lachlan's type. Hagen (1885) described the species from a ♂ of *O. nigra* Hagen, from Amballa (supra); the female he described, thinking it to belong to *O. michaeli*, was *Parembia valida* (Hagen) (= *Embia major* Imms).

Friederichs (1934, p. 415, figs. 5*a-c*) described both sexes from specimens collected at Pahang, Malay States. This description agrees moderately closely with M'Lachlan's type, in size and colour as well as in the structure of the head and antennae. The terminalia seem scarcely distinguishable from *O. ceylonica* Enderlein 1912; Enderlein's description of the head and antennae of this species (1912, p. 83) agree with Friederichs' data. However, a specimen from Ceylon described in this paper (infra), which seems almost certainly to belong to *O. ceylonica*, is not very strongly suggestive of M'Lachlan's type. In any case, the data are insufficient for the rejection of Enderlein's name in favour of *O. michaeli*.

Mukerji (1935, p. 7, fig. 3) described a male (Assam, Shillong, 4900 ft.). Only the terminalia were described, so that there is no means of comparing this specimen with M'Lachlan's type. It would appear from Mukerji's figure that he was dealing with an unnamed species.

The larva which Krauss (1911, p. 36) believed to belong to *O. michaeli* is probably referable to *Parembia*; the locality is Bombay. Krauss's figure (Pl. i, fig. 5B) shows two hind metatarsal bladders, proving that the specimen is not referable to *Oligotoma*.

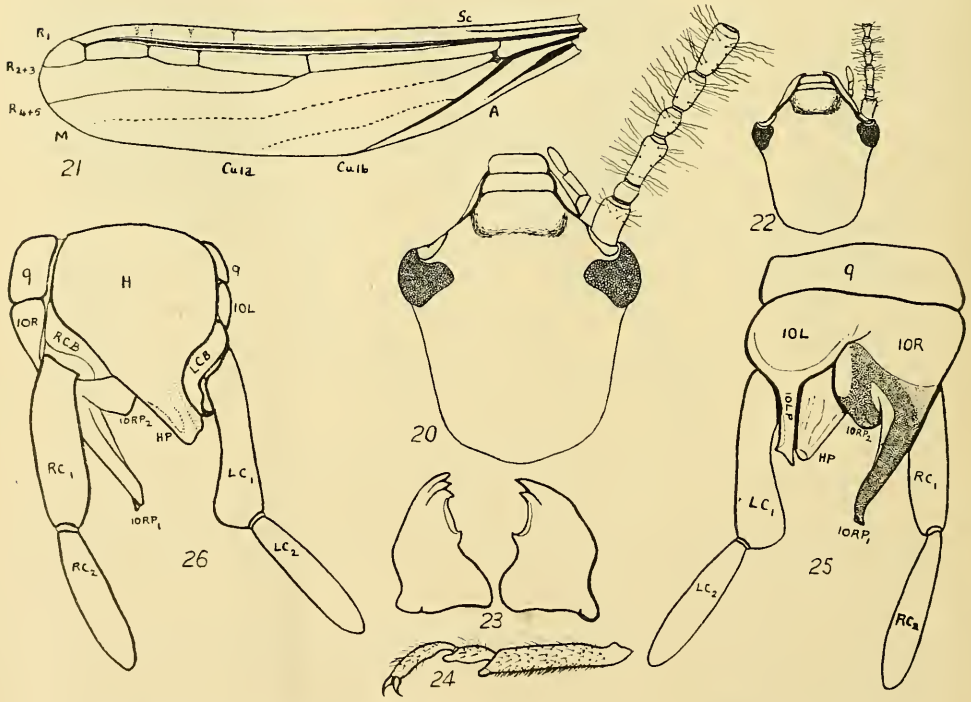
Enderlein (1912, p. 89) referred a female from Java to *O. michaeli* M'Lachlan, erecting a new variety (var. *javana*). The specimen might belong to any species of *Oligotoma* or even, to judge from the description, to *Ptilocerembia roepkei* Friederichs 1923. Enderlein's name, being varietal, need receive no consideration.

OLIGOTOMA THORACICA, n. sp. Figs. 22–26.

Oligotoma collaris Navás, 1928, *Ann. Mus. Civ. Storia Naturale, Genoa*, 53, p. 388.—Not *Haploembia collaris* Navás 1923*a*, *Rev. Acad. Cienc. Zaragoza*, viii, p. 14.

Haploembia collaris was described from a female, from Elisabethville, Belgian Congo; it is probably not a *Haploembia*, and in any case is unrecognizable (Davis, 1939*d*). Two males in the Genoa Museum, from Burma ('Carin Chebà, 900–1100 m(etres), L. Fea, VI.88'), were described as the males of the Elisabethville female, and the species transferred to *Oligotoma* (Navás, 1928). This course was followed on account of a resemblance in coloration.

Colour is a relatively unimportant character in the Embioptera, and many quite unrelated species have the same colour characters as the above specimens (dark brown with orange-brown prothorax). It is a geographic impossibility for the males to belong to the Congo species, to which, unrecognizable though it is, the name *collaris* is rightly limited. Apart from the introduced species (*O. saundersii* Westw.), *Oligotoma* is not known from the Congo, and the males mentioned above cannot belong to a Congo species. They are therefore described as new.



Figs. 20-21.—*Oligotoma michaeli* M'Lachlan, holotype ♂. 20. Head from above, × 20. 21. Left forewing, × 8, somewhat crumpled.

Figs. 22-26.—*Oligotoma thoracica*, n. sp., cotype ♂. 22. Head from above, × 8. 23. Mandibles from above, × 20. 24. Hind tarsus viewed laterally, × 20. 25. Terminalia from above, × 20. 26. Terminalia from below, × 20; process of hypandrium, distad to dotted line, sclerotized only very weakly.

♂. Length 13–15 mm.; head 2·3–2·7 × 1·9–2·1 mm.; forewing 10–11 × 2·3–2·5 mm.; hindwing 8·5 × 2·3–2·5 mm. General colour as in the type of *O. michaeli*, except that the pronotum is orange-brown, and, in the larger of the two specimens, most of the fore-legs also. Head structure (Fig. 22) as in the type of *O. michaeli*; the antennal pubescence also agrees. The smaller specimen has 25 antennal segments, the terminal ones no paler than the rest, the long wavy hairs absent from the last six segments. Navás (1928) gives the number of antennal segments as 31, last segment pale. Mandibles (Fig. 23) with terminal and subterminal teeth directed inward, acute, the left with three, the right two; basad to these is a slight concavity on the inner margin, and a medial tooth, subacute, curving forward. Wings as in *O. michaeli* (cf. Fig. 21), except that the larger specimen has more cross-veins (some 7 from R_1 to sector, and in one wing a trace of one from R_{2+3} to R_{4+5}). Hind tarsi (Fig. 24) normal for the genus. Terminalia (Figs. 25–26) very distinctive; posterior process of right hemitergite ($10RP_1$) elongate, tapered, terminally curved slightly to the right, and truncate, with two weakly-formed teeth, the outer one more dorsal in position; inner process ($10RP_2$) normal. Process of left hemitergite (10LP) straight, distally slightly expanded and obliquely truncate. Right cercus with two elongate subcylindrical segments (RC_1, RC_2), with a small basipodite (RCB). First segment of left cercus (LC_1) elongate, terminally slightly dilated inward; second segment (LC_2) subcylindrical. Hypandrium (H) produced backward to a tapered process (HP), curved slightly to the left, obliquely truncate, terminally membraneous at sides, with a medial membraneous bay. Left cercus-basipodite (LCB) probably composite (supra), fused to left side of H, terminally curved out in an acute hook.

♀ unknown.

The two cotype males are in the Genoa Museum.

This is the largest known species of *Oligotoma*, and is very distinctive in many respects. It has a great structural similarity to the type of *O. michaeli* in the parts preserved in the latter. If this similarity extends to the terminalia, none of the species described by Hagen, Mukerji or Friederichs (supra) as *O. michaeli* can be closely related to that species. The specific identity of *O. michaeli* and *O. thoracica* seems unlikely, in view of the fact that the former has the prothorax concolorous with the rest of the body; although colour is unimportant, it should not be neglected entirely.

OLIGOTOMA BORNEENSIS Hagen 1885. Figs. 27–37.

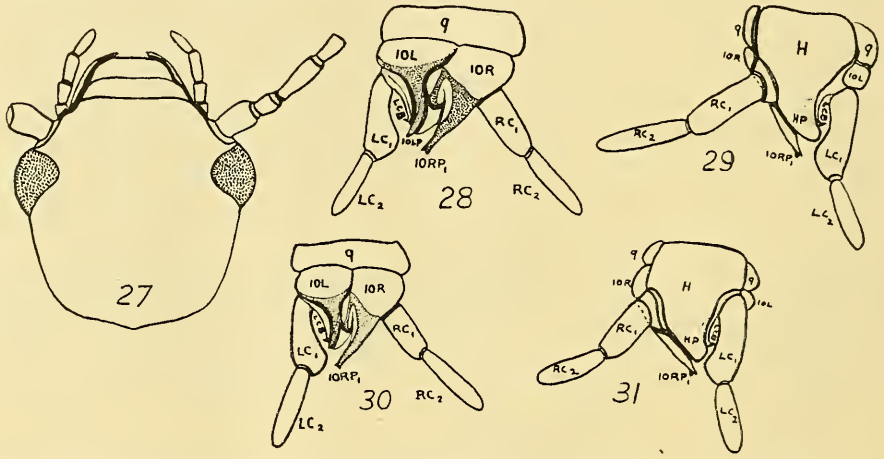
Canadian Entomologist, 17, p. 146.

Hagen (l.c.) re-described *Oligotoma saundersii* Westw. from eight examples (♂) from Borneo. Concerning these, he wrote: 'Their different colour [from previous descriptions of *O. saundersii*—C.D.] induced me to name them as a new species, especially as mine are well preserved in alcohol, and Wood-Mason's, of the same uniform brown colour, were also in alcohol. Thirty years ago I twice studied the type of *E. Latreillii* Ramb. As I do not find my notes, I believe it to be more prudent to unite the Borneo specimens with *O. saundersii*, the more so as Rambur's description agrees'. Krauss (1911) lists *O. borneensis* Hagen under the synonymy of *O. saundersii*.

Hagen's eight specimens are in the Museum of Comparative Zoology, Harvard University, consisting of four males in alcohol, labelled 'Telang, Borneo,—12.81'; 'Hagen'; 'Olig. Borneense Hag.' (sic), in Hagen's writing; three males in alcohol, labelled 'Lambang Hiang, Borneo, Sept. '81. Graborsky'; 'Hagen'; and one pinned

male, presumably Hagen's eighth specimen, labelled 'Duson Timor, Borneo, 1.82'. These eight specimens are all conspecific with the species now known as *Oligotoma vosseleri* (Krauss 1911). They are no relation to *O. saundersii* in any sense. It appears that *O. borneensis* must displace Krauss's name; Hagen's name cannot be classed as a nomen nudum, as the whole of his lengthy re-description of *O. saundersii* refers only to these eight specimens.

The series from Telang, S.E. Borneo, bearing Hagen's label 'Olig. Borneense', may be taken as the type series; the other series agree in size, colour and structure. The type series is described below.



Figs. 27-31.—*Oligotoma borneensis* Hagen, cotype ♂, Telang, Borneo. 27. Head from above, × 27. 28. Terminalia from above, × 27. 29. Terminalia from below, × 27. 30, 31, another ♂ from the same series, figured as in Figs. 28, 29.

♂. Length 7·5–9 mm.; head 1·2–1·5 × 1·0–1·1 mm.; forewing 4·5–6 × 1·3–1·5 mm. General colour uniform mid-brown, head a little darker, eyes black; wing-veins dark brown, bordered by brown bands. Head (Fig. 27) with rather large prominent eyes, sides behind eyes rounded, converging posteriorly. Mandibles with internal terminal and subterminal teeth (left three, right two), basad to which is a cutting edge, a small blunt tooth, and a semicircular concavity. Antennae with up to 18 segments (in one specimen, 15 segments on each side); antennal length some 3·5 times the head-breadth. Wings and tarsi normal for the genus. Terminalia (Figs. 28–31) with tenth abdominal tergite divided into left and right hemitergites (10L, 10R), the suture oblique, proximally obsolescent. 10R with outer process ($10RP_1$) almost straight, terminally carrying two toothlets, the outer one blunter and more dorsal in position. Inner process ($10RP_2$) normal. Process of left hemitergite (10LP) as in *O. nigra*. Right cercus and basipodite normal; first segment of left cercus (LC_1) slightly dilated subterminally on the inner side, dilation somewhat variable (cf. Figs. 28, 30). Second segment (LC_2) subcylindrical. Hypandrium (H) produced back to an obtuse process (HP), curved to the left. Left cercus-basipodite (LCB) probably composite, fused to left-hand margin of H, terminally curved out in an acute hooklet.

♀. Cf. Krauss, 1911, p. 49.

Synonymy and Distribution:

Aposthonia vosseleri Krauss 1911, *Zoologica*. Hft. 60, Bd. 23, p. 48.—*Oligotoma vosseleri* (Krauss 1911), Enderlein, 1912, *Coll. zool. de Selys-Longchamps*, fasc. 3, p. 101.—Krauss's figures of the type ♂ (l.c., Pl. ii, figs. 14, 14A-G) agree well with Hagen's type series of *O. borneensis*; the size also agrees, the colour is somewhat paler. Krauss's figures of the first segment of the left cercus (14D, F) show it as somewhat more slender than in the types of *O. borneensis*, but the thickness varies slightly in the two figures (dorsal and ventral view). Minor variations in the degree of dilation of this segment are characteristic of *O. borneensis*.

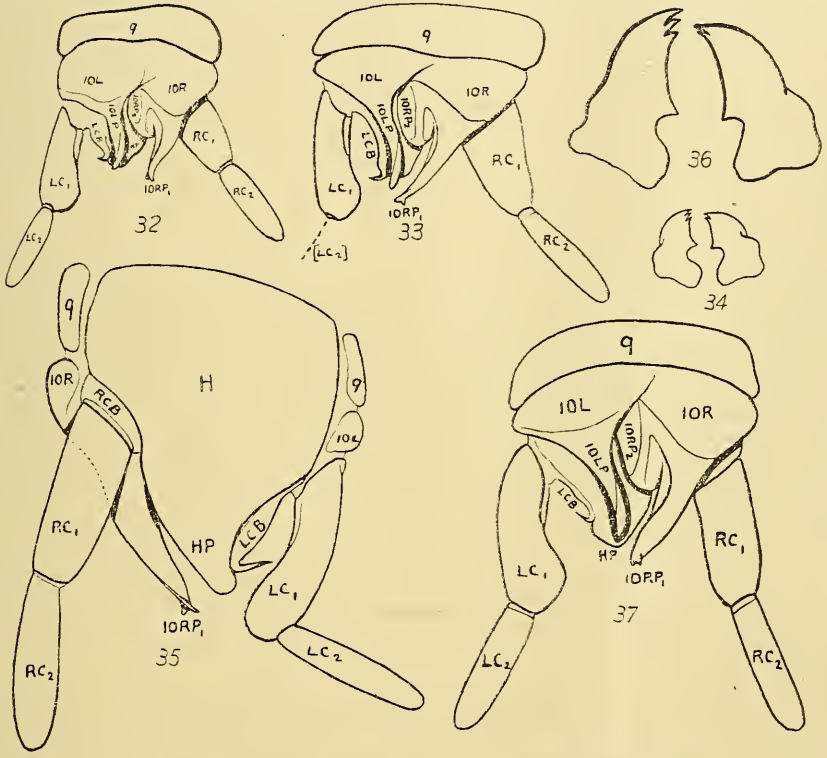


Fig. 32.—*Oligotoma borneensis* Hagen, ♂, from Vigan, Luzon (type of *Oligotoma masi* Navás). Terminalia from above, × 28.

Fig. 33.—*Oligotoma borneensis* Hagen, ♂ from Malaya. Terminalia from above, × 40.

Figs. 34-35.—*Oligotoma borneensis* Hagen, ♂ from Hainan. 34. Mandibles from above, × 20. 35. Terminalia from below, × 60.

Figs. 36-37.—*Oligotoma borneensis* Hagen, ♂ from Tonkin. 36. Mandibles from above, × 40. 37. Terminalia from above, × 40.

Krauss's type ♂ (Mus. Stuttgart) is from Padang, Sumatra; a male from Ceylon (coll. W. Horn; identified by Dr. Friederichs), listed by Krauss (l.c.) under *A. vosseleri*, probably belongs to *O. ceylonica* End. (q.v.), a species which appears to be fairly closely related to *O. borneensis* (infra).

Oligotoma jacobsoni Silvestri 1912, *Tijd. voor Entom.*, 55, p. 334.—The specimen on which this species was based, from Java, is, according to Silvestri's figure, a normal male of *O. borneensis*, the dilation of the first segment of the left cercus being only very slightly different from that in a specimen determined by Silvestri

(l.c.) as *O. vosseleri* (i.e. *O. borneensis*). The colour is apparently darker than in the type of '*O. vosseleri*', agreeing rather with Hagen's series.

Oligotoma maerens Roepke 1919, *Treubia*, i, p. 5.—Allowing for a slight distortion of the segments of the cerci during preparation on a slide-mount, Roepke's figure of the terminalia of this species (l.c., fig. 7) agrees with *O. borneensis* in all respects. It is rather large (length 9·5 mm.; head 1·7 × 1·2 mm.) and dark (Roepke gives: 'Black, with a tinge of dull reddish-violet'). It cannot be considered as structurally distinct from *O. borneensis*, but may be regarded, without name, as a colour-form. The localities are Merbabu, Getassan and Salatiga, Central Java.

Oligotoma nana Roepke 1919, l.c., p. 20.—The specimens described by Roepke differ from the type series of *O. borneensis* only in their small size (length 5 mm.); the colour is described as 'light reddish-grey', probably a different way of describing the normal colour for the paler specimens of *O. borneensis*. The data given for the relative lengths of leg-segments do not serve as a taxonomic criterion; only one (perhaps two) specimens were measured, and the comparison of these measurements with *O. maerens* (i.e. *O. borneensis*) is not significant. Legs regenerating after breakage frequently show such divergence in the relative lengths of the segments. The locality is also Central Java.

Oligotoma masi Navás 1923*b*, *Mem. Pont. Accad. Rom. dei Nuovi Lincei*, Series ii, vol. 6, p. 39.—The type (from Vigan, Luzon, Philippine Isds.; coll. F. Mas, 1919) is recorded as in 'Coll. Navás'. However, in the Paris Museum there is a male labelled 'Oligotoma masi ♂ Nav.; P. Navás S.J. det.'; 'Vigan, Luzon, 1919'; and 'Typus' (Navás' pink type label). It is presumably the type, transferred at some time from the Navás Collection to the Paris Museum. This specimen is a normal example of *O. borneensis* Hagen; the terminalia are illustrated in Fig. 32. The size agrees with Hagen's series (length 7 mm.; forewing 6·5 × 1·8 mm.). The colour (of the dried specimen) is somewhat paler than Hagen's types (in alcohol); it agrees well with dried specimens seen by the writer from Java and Malaya: General colour golden-brown, eyes black, wing-veins dark brown bordered by smoky-brown bands.

Small colour-differences, some perhaps genetic, many undoubtedly concerned with degree of melanization after ecdysis and with method of preservation, cannot be used in this Order as a basis for specific or even racial nomenclature, unless supported by other factors.

Aposthonia vosseleri intermedia Friederichs 1934, *Arch. f. Naturg.*, N.F., Bd. 3, Hft. 3, p. 410.—Friederichs proposed '*intermedia*' as a form, but wrote it as trinomial, the usual annotation of a geographic subspecies. He also reduced *jacobsoni* Silv. and *nana* Roepke to 'forms', but wrote them also as trinomials. *Aposthonia vosseleri intermedia* represents a rather vague colour-difference from the type ('body mid- to dark-brown'), the 'form' *jacobsoni* Silv. being regarded as dark, the type (of Krauss) as lighter. The 'form' *nana* was allowed on size rather than colour.

The recognition of such 'forms' which, as Friederichs (l.c., p. 412) has admitted, do not fit into any regular geographic distribution, does not serve any useful purpose. As noted above, few (if any) are likely to represent genotypic variations, and the time for a genetic examination of the problem is not at hand. In the related species *O. gurneyi*, in a similar case, the subspecific name *O. gurneyi hilli* Davis 1936 has been rejected (Davis, 1938).

Friederichs' localities for the species (regardless of 'form') are: Simalur: Lasikin, Laut Tawar and Sibigo. Sumatra: Padang; Batu; Fort de Kock. Java: Buitenzorg. Malay States: Kuala Lumpur. China: Canton.

Friederichs (l.c., p. 412) also introduced the terminology '*Aposthonia vosseleri obscura*' (under f. *jacobsoni*). In the British Museum is a male from Malaya ('Khumpur'), labelled '♂ *Aposthonia vosseleri* Krauss f. *obscura* = *Oligotoma jacobsoni* Silv.; det. Friederichs 1936'. This specimen was dried, and had not been prepared, indicating that the determination of the form was intended to be based on colour alone, not on structure. The specimen is mid-brown with thoracic nota and back of head paler (ferruginous), a normal coloration for *O. borneensis*. The terminalia are here figured (Fig. 33); in the tip of the outer process of the right hemitergite, and the more excavate base of the first segment of the left cercus, the specimen is intermediate between the typical *O. borneensis* and the Cingalese *O. ceylonica* End. (infra); this might be expected in a Malayan specimen.

Mature males of *O. borneensis* from the following localities have been examined by the writer, in addition to those noted above:

Buitenzorg, Java (Zool. Museum, Buitenzorg): A number of specimens (♂), some determined by Friederichs as *Oligotoma vosseleri*. All agree substantially with Hagen's types, some being a little paler, and with the first segment of the left cercus a little less dilated.

Dwa Bi, Hainan Island (coll. L. Gressitt, 20.7.35; Museum of Comparative Zoology, Harvard University). A series of males, general colour golden-brown, eyes black, wings with dark-brown veins bordered by smoky-brown bands; length 6·5–7·5 mm.; head 1·3–1·6 × 1·1–1·2 mm.; forewing 5–6 × 1·2–1·8 mm.; hindwing 4·5–5 × 1·2–1·8 mm. Mandibles (Fig. 34) and terminalia (Fig. 35) as in Hagen's types, the hooklet at the end of the left cercus-basipodite (LCB) somewhat longer, the first segment of the left cercus (LC_1) a little more slender.

Ta Hian, Hainan Island (coll. L. Gressitt, 13.6.35; Museum of Comparative Zoology). A male agreeing with the above, slightly larger (length 9 mm., head 1·3 × 1·0 mm., forewing 7 × 1·4 mm., hindwing 6 × 1·4 mm.).

Pattam, Tonkin (coll. R. E. Wheeler, 12.29; Museum of Comparative Zoology). Two males, agreeing with the above; length 8–9 mm.; head 1·3–1·4 × 1·1–1·2 mm.; forewing 6–7 × 1·7–1·8 mm.; hindwing 5–6 × 1·7–1·8 mm. Mandibles (Fig. 36) somewhat more slender, terminalia (Fig. 37) well within the present specific concept.

Galog River, Mt. Apo, Mindanao, Philippine Isds., at 6000 ft. (Museum of Comparative Zoology). A specimen (♂) agreeing with Hagen's series, but with the terminal hooklet of the left cercus-basipodite shorter and blunter. In this respect it approaches *O. japonica* Okajima (Japan, Formosa; infra), although a specimen from Luzon (type of *O. masi* Nav.), to the north of Mindanao, fails to show this approach to *O. japonica*. Four males from Los Baños, Philippine Isds. (Museum of Comparative Zoology) also agree with Hagen's type series in all respects.

Oligotoma albertisi Navás 1930. Figs. 38–42.

Brotéria, Série Zoológica, xxvi, fasc. 1, p. 20, fig. 2.

The following re-description is from the unique type ♂ (Mus. Genoa):

♂. Length 9 mm.; head 1·8 × 1·5 mm.; forewing 8 × 2·2 mm.; hindwing 6·5 × 2·0 mm. Colour (dry): Head dark brown, almost black, eyes black, antennae dark brown. Pronotum dark golden-brown, meso- and metascutum dingy yellowish-brown; legs dark brown; abdomen dark brown. Wing-membrane very dark smoky grey-brown, R_1 and cubital stem almost black; inter-venal lines very fine, hyaline. Head (Fig. 38) rather elongate, eyes prominent, sides behind eyes converging slightly posteriorly. Antennae incomplete; structure of mandibles not determined,

the type being unique. It is therefore impossible to be certain whether the basal concavity of the mandibles is present as in the related *O. borneensis* and *O. gurneyi*. Wings (Fig. 39) and hind tarsi (Fig. 40) normal for the genus. Terminalia (Figs. 41–42) showing general similarity to *O. borneensis*, of which this may possibly prove to be a subspecies. The outer process of the right hemitergite ($10RP_1$) has its distal truncate face broader, the two component teeth being less prominent than in *O. borneensis*. The first segment of the left cercus (LC_1) has the internal dilation smoother and less prominent than in *O. borneensis*. The greatest difference lies in the left cercus-basipodite (LCB), which in *O. borneensis* is curved outward terminally as a sharp hook; in *O. albertisi*, it agrees with the East Australian *O. gurneyi gurneyi* Frogg. in being obtusely tapered and scarcely curved outward terminally. *O. albertisi* differs from all subspecies of *O. gurneyi* in the process of the left hemitergite (10LP), which is simply tapered, as in *O. borneensis*; it lacks the terminal hook characteristic of *O. gurneyi*.

♀ unknown.

Locality.—Katau, New Guinea, coll. L. M. D'Albertis, 1875.

Oligotoma japonica Okajima 1926. Figs. 43–45.

J. Coll. Agric. Imp. Univ. Tokyo, 4, p. 414, Pl. xxxii.

This species is apparently very closely related to *O. borneensis*. Winged and wingless forms of the male are known. The dimensions are: Winged ♂, length 6·5–8 mm., head 1·0–1·1 × 0·8 mm., forewing 5·0–5·6 × 1·2–1·4 mm., hindwing 4·0–4·8 × 1·2 mm. Wingless ♂, length 8–9 mm., head 1·3 × 0·8–1·1 mm. ♀, length 10 mm., head 1·3 × 1·0 mm. General colour dark brown. Terminalia (Fig. 43, after Okajima, l.c., Pl. xxxii, fig. 7) agreeing closely with *O. borneensis*, the first segment of the left cercus (LC_1) slightly different in the position and extent of the internal dilation, the left cercus-basipodite (LCB) with no terminal hooklet. In this last respect, *O. japonica* agrees with *O. albertisi*; both are possibly subspecies of *O. borneensis*, and it is interesting to find this character arising at opposite ends of the specific range (Japan, New Guinea), with typical specimens (LCB hooked) in intermediate zones (e.g. Philippine Isds.).

Localities based on mature males (from Okajima, l.c.): Kagoshima Province, Kyushu proper and islands between Kyushu and Loochoo.

A male in the Museum of Comparative Zoology from Urai, Formosa (coll. L. Gressitt, 1.5.32), i.e. from some distance to the south of the former known range, appears to be referable to *O. japonica*. The first segment of the left cercus appears slightly more irregularly dilated, but the specimen actually had this structure somewhat distorted in the course of preparation. The dimensions (length 6·5 mm., head 1·2 × 0·9 mm., forewing 5 × 1·2 mm., hindwing 4 × 1·2 mm.) and colour agree with *O. japonica*, as does the left cercus-basipodite (Fig. 45). The mandibles (Fig. 44) have the basal internal concavity less marked than in the normal *O. borneensis*. Full details of the mandibles are not given by Okajima.

Oligotoma varians Navás 1922. Figs. 46–48.

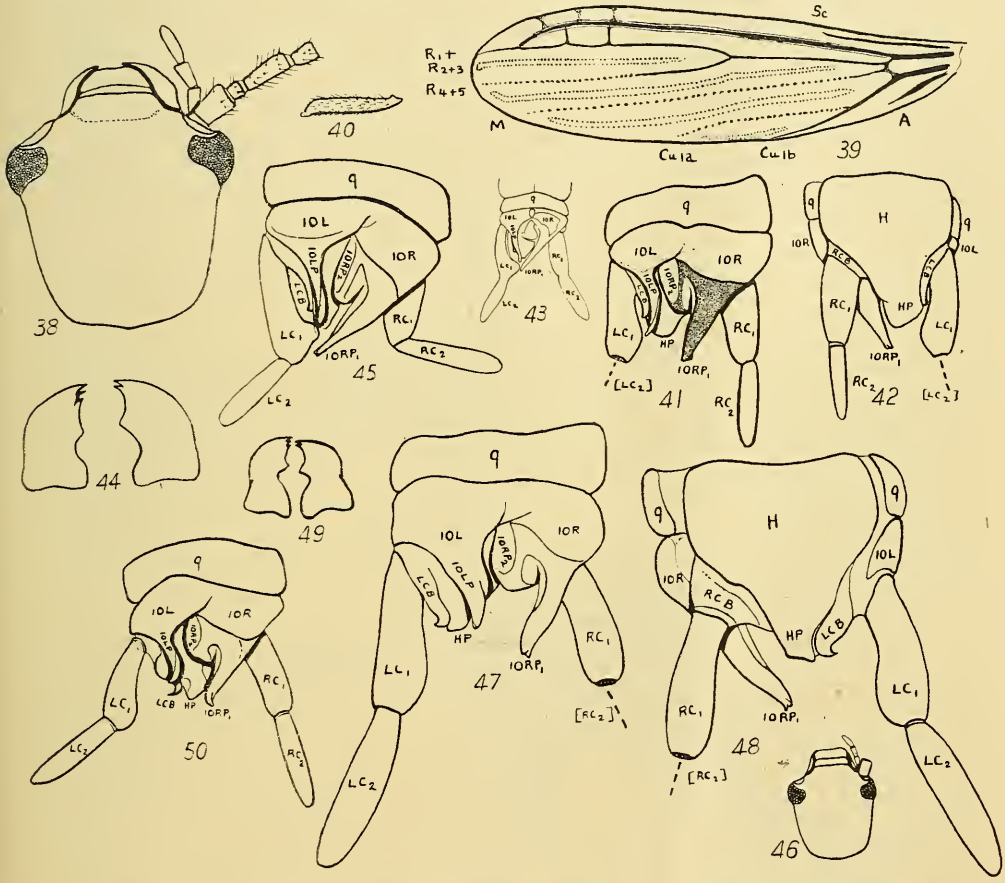
Rev. Acad. Cienc. Zaragoza, vii, p. 32.

The following re-description is from the unique type ♂ (Mus. Paris):

♂. Length 10·5 mm.; head 1·8 × 1·5 mm.; forewings missing, hindwing 7 × 2 mm. General colour dark brown, almost black, wing-veins dark brown bordered by dark smoky-brown bands. Head (Fig. 46) rather elongate, sides converging slightly posteriorly. Venation and tarsi normal for the genus. Terminalia (Figs. 47–48) agreeing rather closely with *O. borneensis*, outer process

of right hemitergite ($10RP_1$) broader, left cercus-basipodite (LCB) rather thick, terminal hook shorter and broader than in *O. borneensis*, whole structure weakly sigmoid. Process of left hemitergite (10LP) very broad; further collecting may prove this to be teratological or individual. 10LP obtusely tapered, with a longitudinal groove on the inner margin. First segment of left cercus (LC_1) scarcely dilated distally. $10RP_2$ rather obtuse.

♀ unknown. (The data given by Navás, l.c., refer to a female from the same locality, but probably not conspecific. It is also in the Paris Museum. The



Figs. 38-42.—*Oligotoma albertisi* Navás, holotype ♂. 38. Head from above, × 20. 39. Left forewing, × 8, inter-venal lines enclosed by dotted lines. 40. First segment of hind tarsus, viewed laterally, × 20. 41. Terminalia from above, × 20. 42. Terminalia from below, × 20.

Fig. 43.—*Oligotoma japonica* Okajima, ♂, terminalia from above, magnification not stated exactly. (After Okajima, 1926, Pl. xxxii, fig. 7.)

Figs. 44-45.—*Oligotoma japonica* Okajima, ♂, from Formosa. 44. Mandibles from above, × 40. 45. Terminalia from above, × 40.

Figs. 46-48.—*Oligotoma varians* Navás, holotype ♂. 46. Head from above, × 8. 47. Terminalia from above, × 28. 48. Terminalia from below, × 28.

Figs. 49-50.—*Oligotoma* ? *varians* Navás, ♂ from Kwantung. 49. Mandibles from above, × 20. 50. Terminalia from above, × 20.

pronotum is a bright orange-brown; in *O. varians* ♂ it is concolorous with the rest of the body).

Locality.—Gan Chouen Fou, Anshunfu, China, coll. P. Cavalerie, 1912.

This species may later prove to be distinct only subspecifically from *O. borneensis*. Preparation of the unique type to reveal the structure of the mandibles was considered inadvisable.

A male in the Museum of Comparative Zoology, Harvard University, from Yim Na San, East Kwantung, South China, seems to be referable to *O. varians* or to an intermediate between it and *O. borneensis*; the latter would suggest subspecific status for *O. varians*. The colour and dimensions (length 10 mm.; head 1·4 × 1·1 mm.; forewing 7·5 × 1·6 mm.; hindwing 6·5 × 1·6 mm.) agree with *O. varians*. The mandibles (Fig. 49) resemble *O. borneensis*, with a less marked basal concavity internally. The terminalia (Fig. 50) appear to be intermediate in the breadth of $10RP_1$ and the dilation of LC_1; the left cercus-basipodite (LCB) resembles *O. varians*, but is even more markedly sigmoid. The process of the left hemitergite (10LP) is normal for *O. borneensis*, suggesting malformation of this structure in the type of *O. varians*.

Oligotoma ceylonica ceylonica Enderlein 1912. Figs. 51–61.

Oligotoma ceylonica Enderlein 1912, *Coll. zool. de Selys-Longchamps*, fasc. 3, p. 83, fig. 56.

This species was described by Enderlein from males taken at Peradeniya, Ceylon. The types are recorded as in the Stettin Museum. Enderlein (l.c.) gave a crude line-figure. Mukerji (1935, p. 4) described males from the type locality (Peradeniya) and from Eastern India (Barkuda Island, Chilka Lake), introducing the new varietal name *O. ceylonica* var. *variegata* for both series. It would appear that the differences noted by Mukerji between his Peradeniya specimens and Enderlein's description are concerned with his more careful study (or Enderlein's lack of detail) rather than with actual structural difference. The Barkuda Island specimens are, likewise, scarcely distinct. Other very different specimens have since been classed under Mukerji's varietal name (Menon and George, 1936; infra).

Enderlein's data may be summarized as follows:

♂. Length 5·5–6·5 mm.; length of head 1·1 mm.; forewing 5·0–5·3 mm., hindwing 4·0–4·2 mm., in length. Colour dark red-brown, head ferruginous. Wings brown, with narrow hyaline inter-venal lines. Head rather small; eyes large, sides of head behind eyes weakly convex. Antennae with 15–17 segments, with long perpendicular hairs. Terminalia (Fig. 51, after Enderlein, l.c., fig. 56) similar to *O. borneensis*; termination of outer process of right hemitergite ($10RP_1$) as in the Malayan example of that species noted above (Fig. 33), the outer toothlet a little less distal in position. No hook-like termination is shown for the left cercus-basipodite, such as characterizes *O. borneensis*.

Mukerji's more careful figures also omit details of the left cercus-basipodite. In other respects (Fig. 52, after Mukerji, l.c., fig. 2*f*) it would appear that the structure, e.g. of the processes of the hemitergites, agrees fairly closely with Hagen's series of *O. borneensis*. However, the first segment of the left cercus (LC_1) is strongly excavate in the basal three-quarters. Minor differences in this structure, and in the tip of $10RP_1$, between the Peradeniya (Figs. 53–54) and Barkuda Island (Figs. 55–56) specimens, are illustrated (after Mukerji, l.c., figs. 2*j-k*, *g-h*).

A male in the Colombo Museum (Mihintale, Ceylon, 7–9.vii.27) seems to be clearly referable to *O. ceylonica ceylonica*: Length 6·5 mm.; head 1·9 × 1·6 mm.; forewing 5·0 × 1·1 mm.; hindwing 4·0 × 1·1 mm. General colour as in the type.

Head and mandibles (Fig. 57) as in *O. borneensis*, the internal concavity of the mandibles less marked. Wings and tarsi as throughout the genus. Terminalia (Figs. 58–61) as in Mukerji's description (supra), the basal excavation of LC_1 less marked, the tip of 10LP and $10RP_1$ slightly different in shape. The region of the left cercus-basipodite differs clearly from *O. borneensis* and related species; a membraneous slit runs obliquely forward into the left-hand side of the hypandrium; on the proximal side of this slit, the outer part of the hypandrium is divided off by a weak suture; this sclerite so cut off probably represents part of a composite left cercus-basipodite. The remainder of the basipodite is represented by a membraneous area between this sclerite and the base of the left cercus, the membrane bearing several small discontinuous sclerotizations.

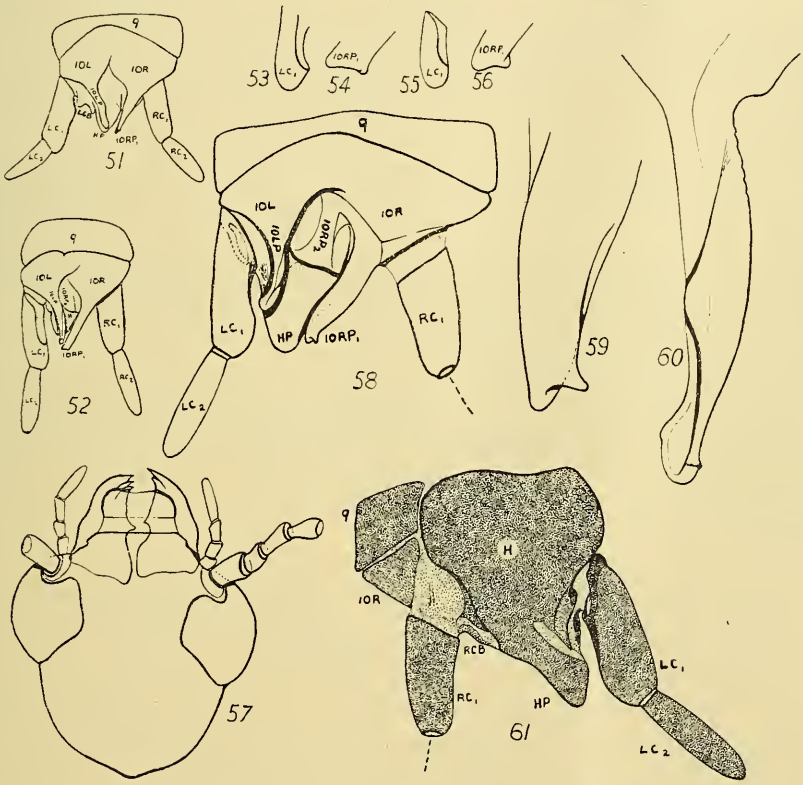


Fig. 51.—*Oligotoma ceylonica ceylonica* Enderlein, ♂, terminalia from above, × 25. (After Enderlein, 1912, fig. 56; type, from Peradeniya, Ceylon.)

Figs. 52-56.—*Oligotoma ceylonica ceylonica* Enderlein, ♂. 52. Terminalia from above. × 12. 53, 54, specimen from Peradeniya, Ceylon. 53. First segment of left cercus from above, × 12. 54. Tip of outer process of right hemitergite from above, × 38. 55, 56, specimen from Barkuda Island, East India: structures and magnifications as in 53, 54. (After Mukerji, 1935, fig. 2, *f*, *j*, *k*, *g* and *h* respectively.)

Figs. 57-61.—*Oligotoma ceylonica ceylonica* Enderlein, ♂ from Mihintale, Ceylon (Colombo Museum). 57. Head from above, × 20. 58. Terminalia from above, × 60. 59. Posterior process of right hemitergite, viewed from above, × 360. 60. Process of left hemitergite from above, × 360. 61. Terminalia from below, × 60.

The absence of the outcurved spine on the left cercus-basipodite is the more remarkable considering its presence in *O. scottiana* End. (Seychelles; infra), the representative of this series from a more westerly locality.

Oligotoma minuta Mukerji 1935 (*Rec. Ind. Mus.*, xxxvii, p. 1), from Calcutta, appears to be a small form of *O. ceylonica ceylonica* End., not specifically distinct. Corresponding forms (without justification for nomenclature) occur in *O. borneensis* Hagen ('*O. nana* Roepke 1919') and *O. gurneyi gurneyi* Frogg. ('*O. gurneyi hilli* Davis 1936').

Oligotoma ceylonica indica, n. subsp. Figs. 62–66.

Oligotoma ceylonica Enderlein, var. *variegata* Mukerji, Menon and George, 1936, p. 92 (Bombay series).

In a very interesting paper, Menon and George (l.c.) referred certain specimens from Cochin (Southern India) and Bombay to *O. ceylonica* var. *variegata*. The Bombay forms are more distinct from *O. ceylonica* End. than is the case for many differences considered as specific in the genus *Oligotoma*; the Cochin forms are intermediate, indicating subspecific rather than specific status for the Bombay specimens.

O. ceylonica seems, therefore, to undergo little change from Ceylon northwards along the East Coast of India, but changes rather remarkably proceeding north-west.

♂ (after Menon and George, l.c.): Length 5–7 mm. Colour as in the type subspecies. Terminalia (Figs. 62–66) immediately differentiated from the type subspecies by the beak-like prolongation of the internal margin of the first segment of the left cercus (LC_1). ♀ unknown.

Locality.—Bombay Presidency: Santa Cruz, Salsette Island; 6 ♂, recorded as in the Bombay University Collection.

The intermediate forms, from Ernakulam, Cochin State, have the first segment of the left cercus less markedly beaked (Figs. 67–69, after Menon and George, l.c.).

Details of the left cercus-basipodite are not given for either the Bombay (type) or Cochin (intermediate) series. The structure is probably inconspicuous, as in the type subspecies.

Oligotoma scottiana Enderlein 1910. Figs. 70–72.

Trans. Linn. Soc. London, Zool., xiv, p. 55.

The following description is from one of Enderlein's cotypes (♂) in the British Museum of Natural History. It may be regarded as the lectotype.

♂. Length 8 mm.; forewing 6·5 × 1·6 mm.; hindwing 5·0 × 1·4 mm. General colour dark brown. Eyes large, sides of head behind eyes converging posteriorly. Wings (Fig. 70) and tarsi normal for the genus, except that R_1 is not confluent with R_{2+3}. Terminalia (Figs. 71, 72) generally similar to *O. borneensis*; outer process of right hemitergite ($10RP_1$) subobtuse, outer tooth situated well before apex. Process of left hemitergite (10LP) broader than in *O. borneensis*, but otherwise similar. First segment of left cercus (LC_1) dilated subterminally on the inner side. Left cercus-basipodite (LCB) as in *O. borneensis*. Hypandrium (H) truncate, right-hand margin terminally represented by a subobtuse tooth, left-hand margin only weakly sclerotized terminally.

Locality.—Mahé, Seychelles, Percy Sladen Trust Expedition.

(Enderlein (l.c.) gives as an additional locality the Cargados Garajos Group. This record is not based on mature males, and has no significance. The presence of *O. scottiana* on Mahé argues for a continental origin, which cannot be extended

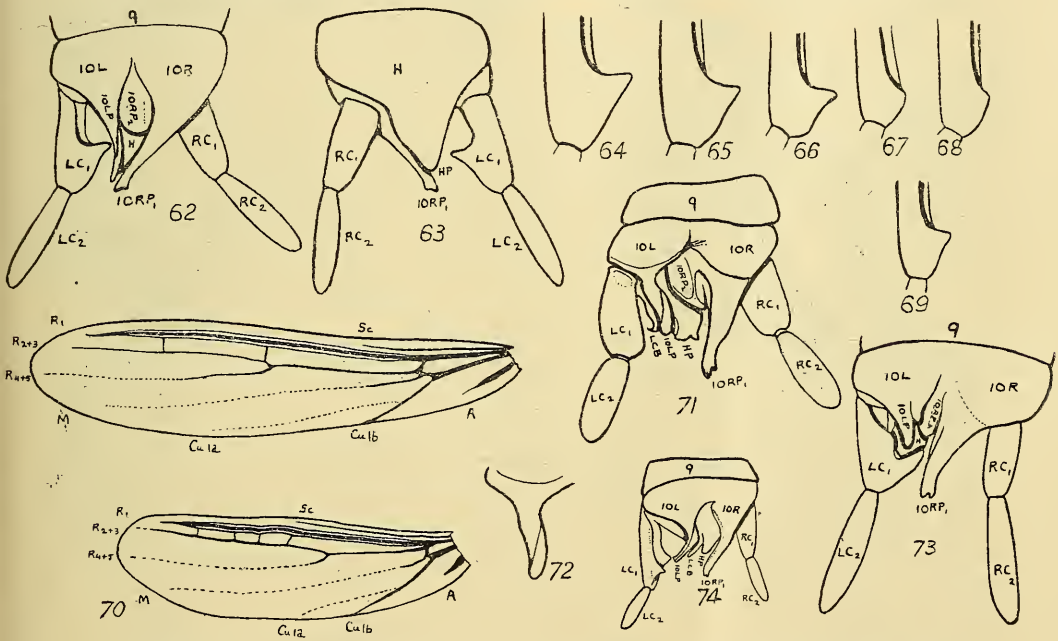
to Cargados Garajos. The specimen from the latter locality probably represents a female of the tropicopolitan *O. saundersii* Westw., spread by man; Enderlein (l.c.) records this species (under the name *O. latreillei* (Ramb.)) from Aldabra Island.)

O. scottiana differs from other species (e.g. *O. borneensis*) by less, probably, than *O. ceylonica indica* differs from *O. ceylonica ceylonica*. Its insular position and isolation suggest that it should be retained as a species rather than reduced to a subspecies of the Eastern series (*O. borneensis*; this latter is probably specifically distinct from *O. ceylonica*, but may include as subspecies *O. varians*, *O. japonica* and *O. albertisi*). A final pronouncement on these questions cannot be given on the available data.

Oligotoma asymmetrica Menon and George 1936. Fig. 73.

J. Bombay Univ., 4, pt. 5, p. 92, Pl. iii.

♂ (after Menon and George, l.c.): Length 9·3 mm.; head 1·5 × 1·2 mm.; forewing 5·5 mm. in length. General colour dark brown (head and prothorax almost



Figs. 62-66.—*Oligotoma ceylonica indica*, n. subsp., ♂. 62. Terminalia from above, × 42. 63. Terminalia from below, × 42. 64-66, variation in first segment of left cercus, × circa 52. (Specimens from Salsette Island, Bombay Presidency, herein named type series. After Menon and George, 1936, Pl. ii, figs. 2*a*, 2*b*, 1*d-f* respectively.)

Figs. 67-69.—*Oligotoma ceylonica*, intermediates between subspecies *ceylonica* End. and *indica*. n. subsp.; ♂ from Ernakulam, Cochin, South India. Variations in first segment of left cercus, × circa 52. (After Menon and George, 1936, Pl. ii, figs. 1*a-c*.)

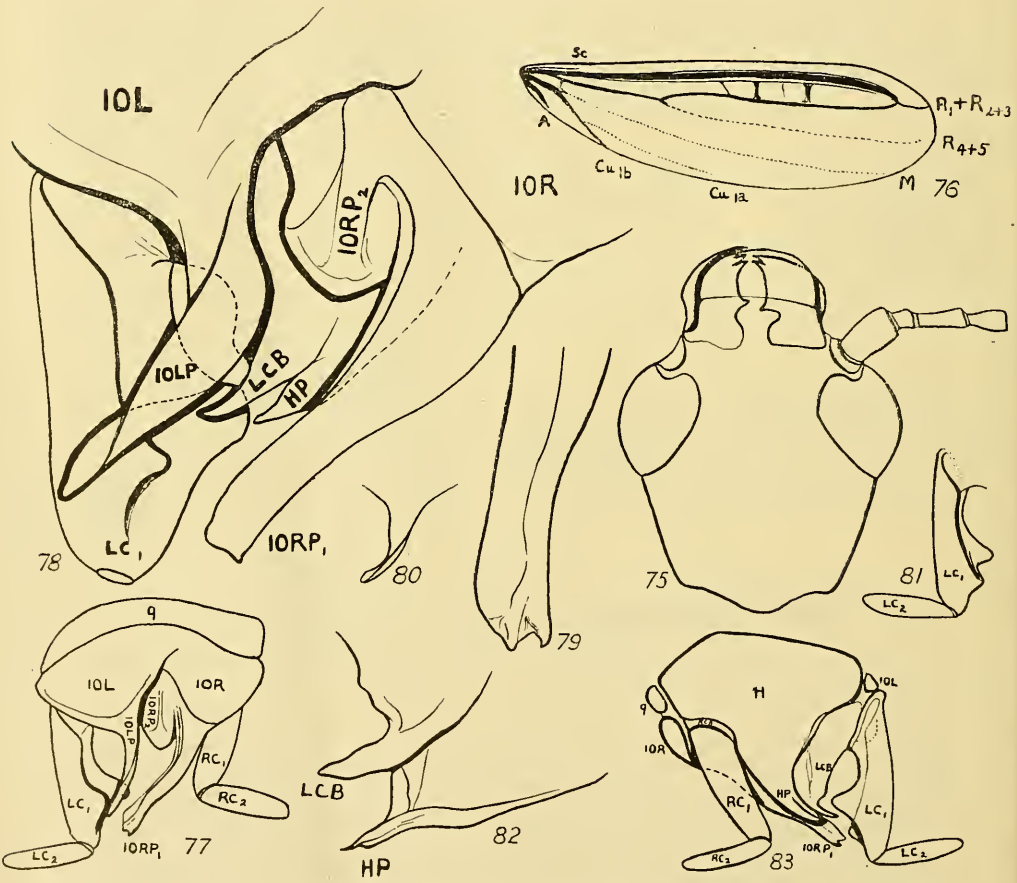
Figs. 70-72.—*Oligotoma scottiana* Enderlein, cotype ♂ (lectotype). 70. Left fore- and hindwing, × 10. 71. Terminalia from above, × 25. 72. Process of left hemitergite from above, × 25.

Fig. 73.—*Oligotoma asymmetrica* Menon et George, ♂. Terminalia from above, × circa 25. (After Menon and George, 1936, Pl. iii, fig. 1.)

Fig. 74.—*Oligotoma minuscula* Enderlein, ♂. Terminalia from above, × 14. (After Enderlein, 1912, fig. 61; from the type, from Daressalam, East Africa.)

black, remainder somewhat lighter). Wings greyish-black, veins brownish-black, inter-venal lines hyaline, distinct. Head rounded; details of mandibles not given. Antennae with 23 segments. Wings normal for the genus. Terminalia (Fig. 73, after Menon and George, l.c., Pl. iii, fig. 1) very distinctive; outer process of right hemitergite ($10RP_1$) rather broad, terminally truncate and weakly bidentate; inner process ($10RP_2$) normal. Process of left hemitergite (10LP) short and obtuse, with a small basal lobe on the right (possibly teratological; cf. the type of *O. varians*). First segment of left cercus (LC_1) remarkable, inner margin produced inwards to two lobes, basal lobe short, subterminal lobe long, slender, curved forward. Hypandrium subtriangular, distally slightly swollen, and concave dorsally; details of left cercus-basipodite not given.

♀ unknown.



Figs. 75-83.—*Oligotoma minuscula* Enderlein, ♂ from Colombo, Ceylon. 75. Head from above, × 60. 76. Right hindwing, × 20. 77. Terminalia from above, × 60. 78. Distal parts of same, exclusive of right cercus and second segment of left cercus, × 180. (Posterior process of right hemitergite distorted terminally.) 79. Posterior process of right hemitergite from above, × 180. 80. Process of left hemitergite from above, × 60. 81. Left cercus from above, × 60. 82. Distal parts of left cercus-basipodite and hypandrium from above, × 180. 83. Terminalia from below, × 60.

Locality.—Bombay Presidency: Santa Cruz, Salsette Island (type presumably in the Bombay University Collection).

Oligotoma minuscula Enderlein 1912. Figs. 74–83.

Coll. zool. de Selys-Longchamps, fasc. 3, p. 87, fig. 61.

♂ (after Enderlein, l.c.). Length 5 mm.; head 1·0 × 0·6 mm.; forewing 3·8 × 1 mm.; hindwing 3·2 mm. × a little less than 1 mm. General colour pale brownish-yellow, wings pale brown, inter-venal lines fine, hyaline. Eyes large; sides of head behind eyes converging strongly posteriorly. Wings normal for the genus. Terminalia (Fig. 74, after Enderlein, l.c., fig. 61) with outer process of right hemitergite ($10RP_1$) curved outward slightly terminally, truncate, with two terminal teeth, the outer one subacute. Process of left hemitergite (10LP) curved to the left, truncate, with a longitudinal groove. First segment of left cercus (LC_1) grooved longitudinally on inner side, each side of the groove (dorsal and ventral) produced in third quarter to an internal angular tooth or lobe.

♀ unknown.

Locality.—Daressalam, East Africa (type in Berlin Zool. Museum).

The discovery of three males in the Colombo Museum (Colombo, Ceylon, coll. 27.11.24, —.9.27 and 26.2.29) enables a fuller description and raises the question whether Daressalam, or Colombo, or both, is the true locality, i.e. whether the record for one of the localities depends on spreading of the species by human transport. Apart from the doubtful *O. westwoodi* Hagen (recorded as probably from Zanzibar; supra), and the pantropic species *O. saundersii* and *O. humbertiana*, the only records of the genus for Africa pertain to *O. nigra*, which may have been spread from Asia (possibly in very early times) by man, e.g. with the cultivation of the date-palm.

Details of the Colombo specimens of *O. minuscula* are:

♂. Length 3·7–4·6 mm.; head 0·7–1·0 × 0·5–0·8 mm.; forewing 3·0–3·6 × 0·9–1·1 mm.; hindwing 2·6–3·0 × 0·9–1·1 mm. Colour as in the type. Head and mandibles (Fig. 75) much as in *O. borneensis*, the head somewhat narrower, with the hind margins more incised laterally. Length of antennae 1·6 mm., with 15 segments on each side. Wings (Fig. 76) normal for the genus. Terminalia (Figs. 77–83) agreeing substantially with Enderlein's description and figure; additional details may be given for the left cercus-basipodite (LCB) (similar to *O. borneensis*, but with the terminal spine broad, subobtuse), and the process of the hypandrium (HP), produced backwards and to the left as a tapered spine. The tip of the process of the left hemitergite (10LP) seems to be smoothly rounded, not truncate.

Australian Species.

Oligotoma glauerti Tillyard 1923, *J. Proc. Roy. Soc. W. Australia*, ix, i; Davis, 1936, p. 242, figs. 6, 13, 20, 27 and 34.

Oligotoma tillyardi Davis 1936, Proc. Linn. Soc. N.S.W., lxi, 5–6, p. 241, figs. 5, 12, 19, 26 and 33.

Oligotoma approximans Davis 1938, Proc. Linn. Soc. N.S.W., lxiii, 3–4, p. 252, figs. 116–119.

Oligotoma gurneyi gurneyi Froggatt 1904, Proc. Linn. Soc. N.S.W., xxix, p. 672.—Davis, 1936, l.c., p. 231, figs. 1, 11, 18, 25 and 32.—Davis, 1938, l.c., p. 252.

Oligotoma gurneyi centralis Davis 1936, l.c., p. 237, fig. 2.

Oligotoma gurneyi spinulosa Davis 1936, l.c., p. 239, fig. 3.

Oligotoma gurneyi subclavata Davis 1936, l.c., p. 240, fig. 4.

Oligotoma gurneyi Frogg., intermediates between subspecies.—Davis, 1936, l.c., p. 239; Davis, 1938, l.c., p. 254; Davis, 1940, Proc. Linn. Soc. N.S.W., lxv, 1–2, p. 158.

The above species and subspecies have been described and figured already in these Proceedings; a repetition of the data seems unnecssary, as the earlier descriptions are in conformity with the descriptions of other species in the present series.

Unrecognizable Species.

Oligotoma ? termitophila Wasmann 1904, Jägerskiöld Exp., No. 13, p. 17; Enderlein, 1912, p. 90.—This species, described from a female from the Sudan, is absolutely unrecognizable; it may belong to one of the tropicopolitan species of *Oligotoma*, or to some other genus. It should be deleted from future lists.

Oligotoma bicingillata Enderlein 1909, *Zool. Anz.*, 35, p. 191.—This name is founded on a female from Pará, Brazil. It is unrecognizable. It may belong to *O. saundersii* Westw. (known to occur in Brazil), or to one of the endemic Neotropical genera.

Oligotoma dichroa Navás 1921, *Rev. Acad. Cienc. Zaragoza*, vi, p. 78.—The type (♂), from Tonkin ('Non loin de la frontière d'Annam, cercle de Ninh binh, an S.S.E. de Hanoi'), is recorded as in the Navás Collection. The terminalia are not described. It would appear from the description that R_{4+5} is forked in the hindwing; this would be unique for *Oligotoma*. The colour and antennae seem to agree with *O. thoracica*, n. sp.; Navás handled the types of the latter without noting any relationship to *O. dichroa*, so that the description of *O. thoracica* as a new species seems justified on the data to hand. *O. dichroa* may be established by a re-examination of the type, if it is still extant.

Discussion.

Taking the Indo-Malayan region as the original home of *O. saundersii* and *O. humbertiana*, and the original range of *O. nigra* (apart from spreading by man) as from Egypt to India, the generic range extends from East Africa (*O. westwoodi*, Pleistocene, and *O. minuscula*) to Egypt, Mesopotamia, Arabia and India (*O. nigra*), with many species in the Indian region, including Burma, Malaya, Ceylon and South China (*O. asymmetrica*, *O. thoracica*, *O. greeniana*, *O. ceylonica*, *O. varians*, *O. borneensis*), *O. borneensis* extending through the East Indies to the Philippines, its northern congener (*O. japonica*) reaching to Southern Japan. To the south, the genus extends through New Guinea (*O. albertisi*) to Australia and Tasmania (*O. gurneyi*), with three very specialized endemic Western Australian species (*O. glauerti*, *O. tillyardi* and *O. approximans*). In the Indian Ocean, *O. scottiana* is confined to Mahé. The possibility of the entire absence of the genus from Africa, apart from distribution by man, has been suggested under *O. minuscula*.

Four species (*O. saundersii*, *O. humbertiana*, *O. nigra* and *O. greeniana*) appear to have the left cercus-basipodite distinct, with a process, and in addition a process on the left of the hypandrium (? left half of larval tenth sternite). The remaining species have an apparently composite structure, the distal part of the 'left cercus-basipodite' probably including the left half of the larval tenth sternite. If subgeneric division is required, the four subspecies listed above would form the type subgenus, and the name *Aposthonia* Krauss 1911 (genotype *O. borneensis*) could be used for the more closely inter-related of the remaining species (*O. japonica*, *O. varians*, *O. albertisi*, *O. scottiana*, *O. ceylonica*, *O. gurneyi*, and probably *O. minuscula*). The adoption of this subgenus would, however, lead to the undesirable splitting off of similar categories including (1) *O. tillyardi* and *O. approximans*;

(2) *O. glauerti*; (3) *O. thoracica*; (4) *O. westwoodi*; (5) *O. asymmetrica*. This course seems unnecessary, so that *Aposthonia* is not allowed even as a subgenus.

Key to the Species and Subspecies of Oligotoma (♂).

The following key, based on the characters of the mature males, serves to distinguish the species and subspecies recognized above:

1. First segment of left cercus with two inner lobes 2
   First segment of left cercus not as above 3
2. Lobes of left cercus placed one above the other, separated by a longitudinal groove ..... *minuscula* End.
   Lobes of first segment of left cercus placed one distad to other, the distal one long, beak-like ..... *asymmetrica* Men. et George.
3. Process of left hemitergite with a lateral lobe, not terminal 4
   Process of left hemitergite without such a lobe 5
4. Lateral lobe of process of left hemitergite oval, obtuse; first segment of left cercus produced inwards very strongly ..... *tillyardi* Davis.
   Lateral lobe of process of left hemitergite acute; first segment of left cercus produced inwards less strongly ..... *approximans* Davis.
5. Process of left hemitergite with a terminal hook 6
   Process of left hemitergite not as above 13
6. Termination of process of left hemitergite a bifid claw directed to the left ..... *humbertiana* (Sauss.).
   Termination of process of left hemitergite not as above 7
7. Termination of process of left hemitergite expanded into a weakly-bilobed lamina, with a small spine on the right ..... *greeniana* (End.).
   Process of left hemitergite not as above 8
8. Termination of process of left hemitergite a simple acute spine bent to the left 9
   Process of left hemitergite ending in an anchor-like hook ..... *glauerti* Till.
9. Right cercus-basipodite produced backwards; Pleistocene; length less than 4·5 mm. ..... *westwoodi* Hagen.
   Right cercus-basipodite small, subannular; Recent; length greater than 6 mm. .. 10
10. First segment of left cercus weakly clavate, inner margin smoothly dilated ..... *gurneyi subclavata* Davis.
    First segment of left cercus with inner margin produced to a process 11
11. Left cercus-basipodite fused to left side of hypandrium, terminally curved to the left as an acute spine ..... *gurneyi spinulosa* Davis.
    Left cercus-basipodite not as above 12
12. Outer process of right hemitergite apically bidentate ..... *gurneyi centralis* Davis.
    Outer process of right hemitergite simply tapered ..... *gurneyi gurneyi* Frogg.
13. Process of left hemitergite smoothly tapered, obtuse or subacute 14
    Process of left hemitergite obliquely truncate distally, slightly expanded ..... *thoracica*, n. sp.
14. Hypandrium with an acute sigmoid spine subterminally on the left; left cercus-basipodite a bilobed plate ..... *nigra* Hagen.
    Hypandrium and left cercus-basipodite not as above 15
15. Hypandrium with an acute subterminal spine arising on the left and curving under the hypandrium to the right, and upward terminally ..... *saundersii* Westw.
    Hypandrium without such a spine 16
16. First segment of left cercus strongly excavate on inner side in basal half; left cercus-basipodite weakly developed 17
    First segment of left cercus not as above; left cercus-basipodite stronger 18
17. First segment of left cercus produced inwards in a strong beak ..... *ceylonica indica*, n. subsp.
    First segment of left cercus not produced inwards strongly .. *ceylonica ceylonica* End.
18. Left cercus-basipodite terminally curved outwards in an acute hooklet 19
    Left cercus-basipodite obtusely tapered terminally 21
19. Outer process of right hemitergite with tooth on outer margin well back from apex ..... *scottiana* End.
    Outer process of right hemitergite not as above 20
20. Left cercus-basipodite broad, sigmoid ..... *varians* Navás.
    Left cercus-basipodite narrower, basally straighter ..... *borneensis* Hagen.

21. First segment of left cercus scarcely clavate; colour dark brown with thoracic nota yellowish; New Guinea ..... *albertisi* Navás.
First segment of left cercus markedly clavate; colour uniform brown; Japan and Formosa ..... *japonica* Okajima.

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